

THE UNIVERSITY OF MICHIGAN

COLLEGE OF ENGINEERING
Department of Electrical Engineering
Space Physics Research Laboratory

Semi-Annual Report

THEORETICAL INVESTIGATION OF PLASMA WAVES
AND SPACE VEHICLE PLASMA SHEATHS

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T H E U N I V E R S I T Y O F M I C H I G A N

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THEORETICAL INVESTIGATION OF PLASMA WAVES
AND SPACE VEHICLE PLASMA SHEATHS

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RESEARCH ACTIVITIES DURING THE REPORTING PERIOD

This is the semi-annual status report under grant No. NsG-525 covering the period from 1 April 1965 to 30 September 1965.

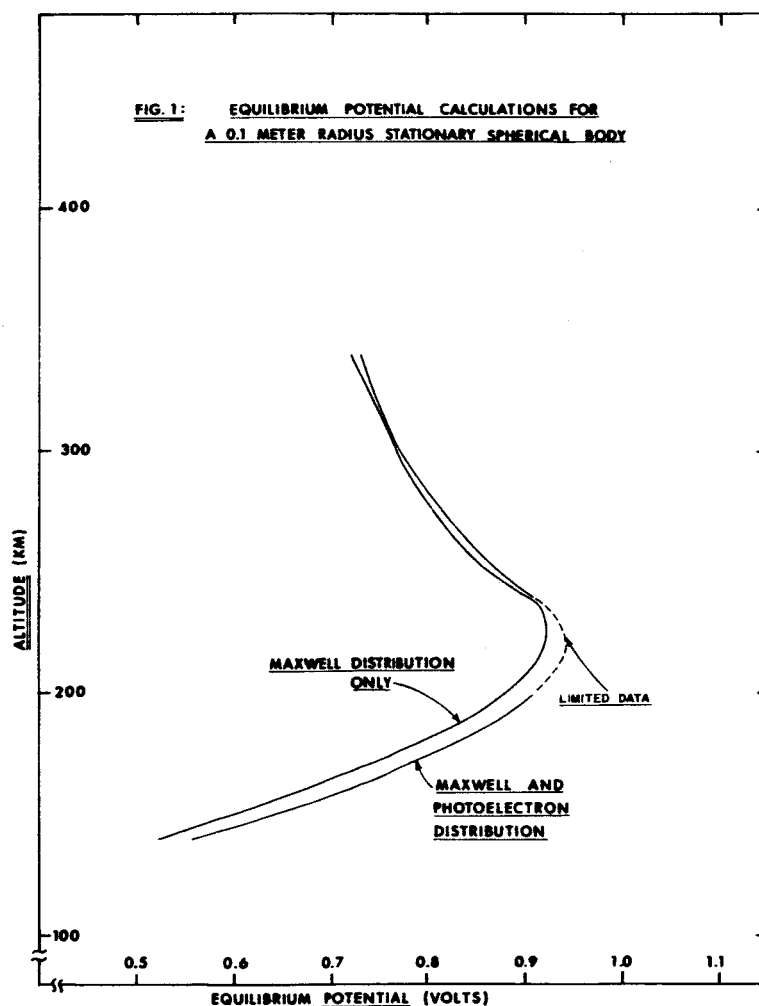
An article entitled "Photoelectron Energy Distribution in the F Region" by W. R. Hoegy, J. P. Fournier, and E. G. Fontheim, will be published in the November 1 issue of the Journal of Geophysical Research. This work was based on the calculations described in the preceeding Semi-Annual Report. This photoelectron distribution has been used to compute the "Contribution of Photoelectron Impact Excitation to the Total Intensity of the 6300⁰Å Dayglow", which is being published as an article by J. P. Fournier and A. F. Nagy in the November 1965 issue of the Journal of the Atmospheric Sciences. An additional paper entitled "Calculated Zenith Intensity of the Second Positive Band of Molecular Nitrogen" by A. F. Nagy and J. P. Fournier has been completed and is scheduled to appear in the December 1 issue of the Journal of Geophysical Research. For the latter paper the photoelectron energy distribution, reported earlier, had to be extended to higher energies.

The article "Ionospheric Electron Density and Body Potential Measurements by a Cylindrical Langmuir Probe" by A. F. Nagy and A. Z. Faruqi appeared in the October 1, 1965 issue of the Journal of Geophysical Research. The work reported in this article was supported in part by this grant.

As is well known, the measured values of the equilibrium potential of space craft and probes in the ionosphere disagree considerably with the theoretically predicted values. Since the calculations have generally been based on the assumption of the Maxwellian electron distribution, a number of authors have recognized that the high energy photoelectron tail may possibly account for at least part of this discrepancy (e.g. Bettinger¹, Nagy and Faruqi²). Calculations have been carried out for the equilibrium potential of a spherical probe using the

photoelectron energy distribution derived here and the electron temperature and density data of Brace et al.³. As indicated in Fig. 1, the shift in the calculated equilibrium potential caused by the photoelectrons is at most about 0.05 volt, which is considerably less than the discrepancy measured in most instances. It is therefore concluded that the neglect of the photoelectrons in the ambient electron distribution cannot explain the difference between the theoretically predicted and experimentally measured values of space craft equilibrium potentials.

The work on the theory of the plasma wave probe and on the volt-ampere characteristics for a cylindrical probe in the presence of a magnetic field is continuing and will be reported in the near future.



REFERENCES

- 1) R. T. Bettinger, "Offset Voltages of Langmuir Probes in the Ionosphere", Rev. Sci. Inst. 36, 630 (1965).
- 2) A. F. Nagy and A. Z. Faruqi, "Ionospheric Electron Density and Body Potential Measurements by a Cylindrical Langmuir Probe", J. Geophys. Res. 70, 4847 (1965).
- 3) L. H. Brace, N. W. Spencer, and G. R. Carignan, "Ionosphere Electron Temperature Measurements and their Implications", J. Geophys. Res. 68, 5397 (1963).

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